

Expanded Anterior Petrosectomy Through the Transcranial Middle Fossa and Extended Endoscopic Transphenoidal-Transclival Approaches: Qualitative and Quantitative Anatomic Analysis

Aurel Hasanbelliu, MD; Norberto O. Andaluz, MD; Alberto Di Somma, MD; Jeffrey T. Keller, PhD; Lee Zimmer, MD; Myles L. Pensak, MD; Ravi Samy, MD; Mario Zuccarello, MD



Departments of Neurosurgery/Otolaryngology Head & Neck Surgery, University of Cincinnati (UC) College of Medicine; Brain Tumor Center at UC Gardner Neuroscience Institute; Mayfield Clinic, Cincinnati, OH

Introduction

Petroclival tumors and ventrolateral lesions of the pons present unique surgical challenges. In this cadaveric study, we provide qualitative and quantitative anatomic analyses of anterior petrous apicectomy through the transcranial middle fossa (TMF) and the extended endoscopic transphenoidal-transclival (EETT) approaches. Specifically, we compared anatomic limitations of both transcranial and endonasal exposures for the petroclival region, discussing how to improve surgical exposures and defining indications for each approach.

Methods

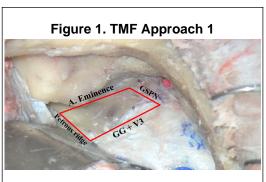
In 10 silicon-injected cadaver heads, the petrous apex and clivus were drilled extradurally through both middle fossa and endonasal approaches. Using *in situ* and frameless stereotactic navigation points, we described and compared consistent data points collected from both approaches to calculate and compare the following:

- respective working areas,
- volumes of bone removed,
- approach angles, and
- surgical freedom.

Results

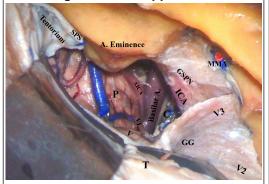
TMF exposures. Exposure of TMF area averaged 21.03 ± 3.46 cm², providing a $44.71 \pm 4.13^{\circ}$ working angle to the brainstem between cranial nerves (CNs) V and VI. Kawase's rhomboid area measured 1.76 ± 0.34 cm2 (Fig. 1). Volume of bone removed at the petrous apex averaged 1.20 ± 0.12 cm3. GSPN-V3 and petroclival angles were 73.8° ± 8.55° and 144.96 ± 1.73°, respectively. Surgical freedom on the lateral brainstem was higher at a point halfway between CNs V and VI at the center of the rhomboid when compared with the midline at the basilar sulcus (P = 0.0003).

EETT exposures. After clivectomy and petrous apicectomy through the EETT approach, area exposed was 5.29 ± 0.66 cm². Boundaries were the CN V anterosuperiorly; anterior wall of the internal acoustic canal posteroinferiorly; carotid genu at the foramen lacerum anterolaterally; and clivus medially. In two sub-areas, one corresponding to the petrous apex and the other to the clivus, measurements were 1.05 \pm 0.44 cm2 and 4.25 \pm 0.44 cm2, respectively. There was no statistically significant difference in surgical freedom at the foramen lacerum and midpoint basilar sulcus when approaching from either nostril (P > 0.05). At the petrous apex, volume of bone removed and area exposed were significantly larger for the TMF approach (P < 0.001).

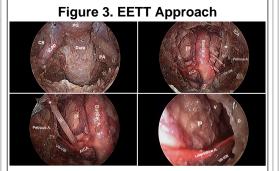


Preoperative view of the anterior temporal fossa depicting Kawase's rhomboid boundaries.

Figure 2. TMF Approach 2



Surgical window obtained after expanded anterior petrosectomy, exposing anterolateral brainstem above the level of V1.



Endoscopic endonasal views compare preand posotoperative views after petrous apicectomy.

Conclusions

- Expanded transclival anterior petrosectomy through the TMF approach provides an adequate corridor to lesions in the upper ventrolateral pons (Fig. 2).
- EETT approach better fits midline lesions that do not extend laterally beyond CN VI and the C3 carotid when evaluating normal anatomical parameters (Fig. 3).

References

 Kawase T, Toya S, Shiobara R, Mine T: Transpetrosal approach for aneurysms of the lower basilar artery. J Neurosurg 1985;63:857–861.
House WF, Hitselberger WE, Horn K: The middle fossa transpetrous approach to the anterior-superior cerebellopontine angle. Am J Otol 1986;7(1):1–4
Van Gompel JJ, Alikhani PA, Tabor

MH, Van Loveren HR, Agazzi SA, Froelich S, Youssef SY: Anterior inferior petrosectomy: defining the role for endonasal endoscopic techniques for petrous apex approaches. J Neurosurg 2014;120:1321–1325.

4. Muto J, Prevedello DM, Ditzel Filho LFS, Tang IP, Oyama K, Kerr EE, Otto BA, Kawase T, Yoshida K, Carrau RL.: Comparative analysis of the anterior transpetrosal approach with the endoscopic endonasal approach to the petroclival region. J Neurosurg 2016;1–16.

http://doi.org/10.3171/2015.8.JNS153 02